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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patentee: Bruce W. Lee, et al. Docket No.: 47406-012500
Patent No.: 6,995,321 B2 Cust. No.: 33717
Issue Date: February 7, 2006
Title: **ETCHED HOLE-FILL STAND-OFF**

Certificate of Mailing

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed Certificate of Correction Division, Commissioner for Patents, Post Office Box 1450, Alexandria, Virginia 22313-1450 on March 15, 2006.

Sherry B. Kolber

REQUEST FOR CERTIFICATE OF CORRECTION

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of Correction

Sir:

Attached in duplicate is PTO Form SB/44, which lists errors in the Patent due to Office Mistakes (37 C.F.R. § 1.322), and due to Applicant's mistakes (37 C.F.R. § 1.323).

CORRECTION DUE TO OFFICE MISTAKE

Pursuant to 37 C.F.R. § 1.322, Patentee hereby requests that the errors listed below be corrected. The exact page/column and line reference in the patent where the corrections should be made are as follows:

In Column 4, line 64, (Claim 4), replace the word "wit" with the word "with";

In Column 5, line 28 (Claim 10), replace the word "wit" with the word "with";

In Column 6, line 37 (Claim 22), replace the word "sex" with the word "set".

MAR 24 2006

CORRECTION DUE TO APPLICANT'S MISTAKE

Pursuant to 37 C.F.R. § 1.323, Patentee hereby requests that the typographical errors listed below be corrected. The exact page/column and line reference in the patent where the corrections should be made are as follows:

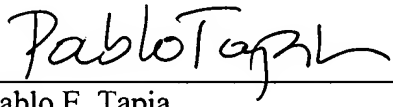
In Column 5, line 5, (Claim 7), after the word "to", insert the word "the";

In Column 6, line 20 (Claim 18), replace the word "on" with the word "one".

The Commissioner is hereby authorized to charge any additional fees which may be required by this paper, or credit any overpayment, to Deposit Account No. 50-2638. Please reference Attorney Docket Number 47406-012500 when charging any payments or credits in connection with this patent.

Respectfully submitted,

Date: March 15, 2006


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UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

Page 1 of 1

PATENT NO. : 6,995,321 b2
APPLICATION NO.: 10/039,942
ISSUE DATE: : February 7, 2006
INVENTOR(S) : Bruce W. Lee and Jesse L. Pedigo

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In Column 4, line 64, (Claim 4), replace the word "wit" with the word "with";

In Column 5, line 5, (Claim 7), after the word "to", insert the word "the";

In Column 5, line 28 (Claim 10), replace the word "wit" with the word "with";

In Column 6, line 20 (Claim 18), replace the word "on" with the word "one";

In Column 6, line 37 (Claim 22), replace the word "sex" with the word "set".

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This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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includes tooling pins 22, holes 36, core 33 and copper layers 31 and 32. A filling mechanism/head 40 is shown filling holes 36 with fill material 41. For holes 36 already filled with fill material 41, a portion of fill material 41 extends into holes 16. FIG. 2 shows an etched stand-off similar to stand-off 10 of FIG. 1 having tooling slots 14 and tooling pin holes 15.

Stand-off 10 is preferably formed from Q-stock (double sided laminate material) having 5–10 oz. copper (layers 11 and 12) on both sides, or by laminating ½–12 oz. copper foil on both sides (layers 11 and 12) of G-10 or other substrate base material. Such a copper clad laminate is imaged using a modified version of art-work derived from a drill-file program of a particular PWB part number, and layer number (depending on which layers of a PWB are designated for drill). The holes within the pattern are imaged to 0.005"–0.100" per side, oversized from a stated finished diameter for each hole. The panel is then run through developers to form the pattern to be etched. The panel is then placed in an etch tank or processed through a conveyORIZED etcher to remove the copper from the areas not protected by the developed resist pattern on the stand-off panel, followed by stripping the resist from the panel and subsequent cleaning. Tooling holes are then drilled or routed into the panel before releasing it for use in the hole fill process. It should be noted that one can also plate up the copper thickness to unlimited thickness if required, and that small relief holes could be drilled using the existing drill program for each particular part number.

Tooling plate 23 can comprise any suitable supporting surface. Although the figure shows the use of pins 21 to align and affix stand-off 10 to tooling plate 23, any suitable means may be used to align and/or couple stand-off 10 to tooling plate 23.

In the preferred embodiment of FIG. 1, PWB 30 rests on top of stand-off 10 but is only bonded to stand-off 10 by pins 22.

Similarly, stand-off 10 preferably rests on tooling plate 23, but is only bonded to tooling plate 23 by alignment pins 21. In less preferred embodiments, stand-off 10 may be bonded, either temporarily or permanently to tooling plate 23, and/or may be temporarily bonded to PWB 30.

Although the figure shows assembly 1 as comprising a printed wiring board 30, any substantially planar device having holes to be filled could be used in place of printed wiring board 30 as long as the device and the stand-off 10 are adapted to be coupled to and aligned with each other so as to assure proper alignment between the pattern on stand-off 10 and the pattern on the device being filled.

Stand-off 10 may be advantageously used in conjunction with a hole-fill method that includes: providing stand-off 10; aligning the stand-off to a tooling plate; aligning the substrate to the stand-off and placing the substrate in contact with the stand-off; and filling the plurality of holes of the substrate. In such a method, it is preferred that providing an etched hole-fill stand-off comprises forming the stand-off previously described. As an example, it may be formed by imaging a copper clad laminate with an image similar to that used to image a surface of the substrate, and subjecting the imaged laminate to develop-etch-strip processing to form a pattern in a copper surface of the laminate, the pattern having a plurality of holes, each of the plurality of holes corresponding to a hole to be filled of the substrate, the laminate holes being at least slightly larger in diameter than their corresponding substrate holes. The foregoing method would typically also comprise filling the through holes of the substrate with a fill material such that the fill material

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extends at least partially into the holes of the stand-off, and removing the substrate from the stand-off wherein substantially all of the fill material extending into the stand-off remains after removal of the stand-off.

An image "similar" to that used on a surface of the substrate being filled will likely have the same pattern of through holes but with the through holes having a larger diameter than provided for in the pattern for the substrate.

It is contemplated that the methods and devices disclosed herein are particularly advantageous when used with a device such as PWB 30 wherein the artwork used to determine the locations of the various holes is available in a form that permits it to be easily modified and re-used to form the similar pattern on stand-off 10.

It is contemplated that assembly 1 may be advantageously used when tooling plate 23 and stand-off 10 are part of a hole fill system that also comprises a pressurized fill head such as fill head 40 of FIG. 1.

Thus, specific embodiments and applications of etched hole-fill stand-offs have been disclosed. It should be apparent, however, to those skilled in the art that many more modifications besides those already described are possible without departing from the inventive concepts herein. The inventive subject matter, therefore, is not to be restricted except in the spirit of the appended claims. Moreover, in interpreting both the specification and the claims, all terms should be interpreted in the broadest possible manner consistent with the context. In particular, the terms "comprises" and "comprising" should be interpreted as referring to elements, components, or steps in a non-exclusive manner, indicating that the referenced elements, components, or steps may be present, or utilized, or combined with other elements, components, or steps that are not expressly referenced.

What is claimed is:

1. An assembly comprising:

an etched hole-fill stand-off wherein the etched hole-fill stand-off comprises a copper clad laminate having a dielectric layer laminated between a first and a second copper layer, wherein the at least one hole of the stand-off is etched through the first copper layer but not through either the dielectric layer or second copper layer;

a tooling plate contacting the etched hole-fill stand-off, the stand-off and tooling plate being aligned to each other;

a device having holes to be filled removably contacting the stand-off, the stand-off and device being aligned to each other; and

the device and the stand-off each having at least one hole, the at least one hole of the device being aligned with the at least one hole of the stand-off.

2. The assembly of claim 1 wherein hole of the stand-off is larger in diameter than the hole of the device.

3. The assembly of claim 1 wherein the device comprises a plurality of holes to be filled and the stand-off comprises a plurality of holes wherein each hole to be filled of the device is aligned with a hole of the stand-off.

4. The assembly of claim 1 wherein the stand-off comprises an external copper layer and the device comprises an external copper layer, the layer of the stand-off being in direct contact with the layer of the device.

5. The assembly of claim 4, wherein the at least one hole of the stand-off extends only through the external copper layer of the stand-off.

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6. The assembly of claim 1 wherein a first set of pins aligns the stand-off to the tooling plate and a second set of pins aligns the device to the stand-off.

7. The assembly of claim 6 wherein the stand-off rests on but is not bonded to tooling-plate other than by the pins aligning the stand-off and the tooling plate, and the device rests on but is not bonded to the stand-off other than by the pins aligning the stand-off and the device.

8. The assembly of claim 1 wherein at least one hole of the device is filled with a fill material that extends partially into a hole of the stand-off without contacting the stand-off.

9. An assembly comprising an etched hole-fill stand-off, the stand-off comprising an etched layer bonded to a non-etched layer; wherein the etched hole-fill stand-off comprises a copper clad laminate having a dielectric layer laminated between a first and a second copper layer wherein the at least one hole of the stand-off is etched through the first copper layer but not through either the dielectric layer or second copper layer.

10. The assembly of claim 9 further comprising:

a tooling plate contacting the non-etched layer of the etched hole-fill stand-off, the stand-off and tooling plate being aligned to each other;

a device having holes to be filled removably contacting the etched layer of the stand-off, the stand-off and device being aligned to each other; and

the device and the stand-off each having at least one hole, the hole of the device being aligned with the hole of the stand-off the hole of the stand-off having a larger diameter than the hole of the device.

11. A method of filling holes in a substrate having a plurality of holes to be filled, comprising:

providing an etched hole-fill stand-off, the stand-off comprising a copper clad laminate having a dielectric layer laminated between a first and a second copper layer wherein at least one hole of the stand-off is aligned with at least one hole of the substrate to be filled, the at least one hole of the stand-off being etched through the first copper layer, but not through either the dielectric layer or second copper layer;

aligning the stand-off to a tooling plate by overlaying the stand-off on the tooling plate;

aligning the substrate to the stand-off and placing the substrate in contact with the stand-off; and

filling the plurality of holes of the substrate.

12. The method of claim 11 wherein the at least one hole of the stand-off is larger in diameter than the at least one hole of the substrate.

13. The method of claim 11 wherein the substrate comprises a plurality of holes to be filled and the stand-off comprises a plurality of holes wherein each hole to be filled of the substrate is aligned with a hole of the stand-off.

14. The method of claim 13, wherein the at least one hole of the stand-off extends only through the external copper layer of the stand-off.

15. The method of claim 11 wherein a first set of pins aligns the stand-off to the tooling plate and a second set of pins aligns the substrate to the stand-off.

16. The method of claim 15 wherein the stand-off rests on but is not bonded to tooling-plate other than by the pins aligning the stand-off and the tooling plate, and the substrate rests on but is not bonded to the stand-off other than by the pins aligning the stand-off and the substrate.

17. The method of claim 11 wherein at least one hole of the substrate is filled with a fill material that extends partially into a hole of the stand-off without contacting the stand-off.

18. An etched hole-fill stand-off to support a printed wiring board, comprising:

a non-etched copper layer;

an etched copper layer having a plurality of etchings, wherein at least one etching of the plurality of etchings is aligned with a hole of the printed wiring board, and a dielectric layer laminated between the non-etched copper layer and the etched copper layer.

19. The etched hole-fill stand-off of claim 18 wherein the at least one etching is larger in than the hole of the printed wiring board.

20. The etched hole-fill stand-off of claim 18 wherein the printed wiring board comprises a plurality of holes to be filled, wherein each hole to be filled of the printed wiring board is aligned with an etching of the plurality of etchings of the stand-off.

21. The etched hole-fill stand-off of claim 20, wherein the at least one hole of the stand-off extends only through the external copper layer of the stand-off.

22. The etched hole-fill stand-off of claim 18 wherein a first set of pins aligns the stand-off to the tooling plate and a second set of pins aligns the printed wiring board to the stand-off.

23. The etched hole-fill stand-off of claim 21 wherein the stand-off rests on but is not bonded to the tooling-plate other than by the pins aligning the stand-off and the tooling plate, and the printed wiring board rests on but is not bonded to the stand-off other than by the pins aligning the stand-off and the printed wiring board.

24. The etched hole-fill stand-off of claim 18 wherein at least one hole of the printed wiring board is filled with a fill material that extends partially into an etching of the stand-off without contacting the stand-off.

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